

# A Super Cooled, Non-toxic, Non-flammable Phase Change Material Thermal Pack for Portable Life Support Systems, Phase I

Completed Technology Project (2008 - 2008)



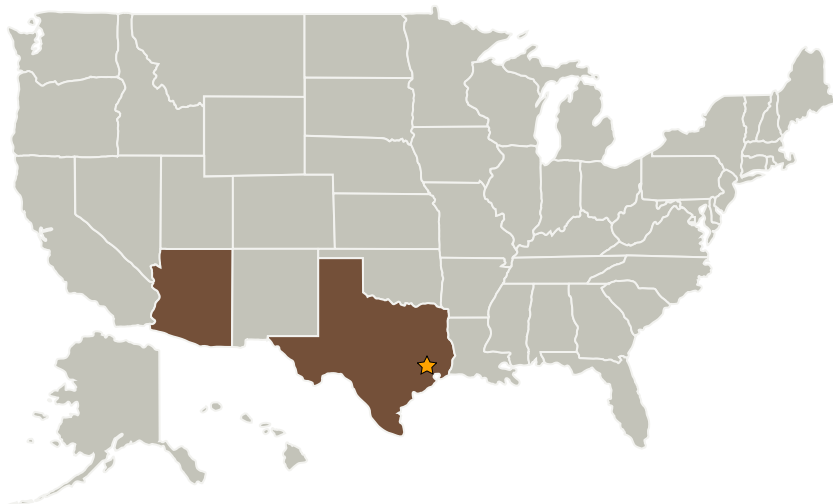
## Project Introduction

The concept development and test of a water-based, advanced Phase Change Material (PCM) heat sink is proposed. Utilizing a novel material choice for both an expansion diaphragm and the PCM case itself, the PCM can accommodate both the expansion of the freezing water-based material and very low temperature of approximately -250F. The water-based PCM itself would be non-toxic and non-flammable, but additives will be included to preclude deterioration of wither the PCM container or the diaphragm material. The use of a water-based PCM gives the highest heat capacity for the mass. This is highly limited due to the needs for portability as required for an Extra-Vehicular Activity (EVA). The total heat capacity of an operational unit would be for full duration EVA use. Through a logical progression of tasks including concept of operation formulation, requirements formulation, concept design reviews and detail design reviews that include design and thermal analysis using Thermal Desktop

TM

models, this effort can progress from TRL 2 to TRL 3. The team will confirm the robust choice of diaphragm materials, the choice of casing material and the choice of the additives to the water used for the PCM. The PCM will be tested to confirm heat input/temperature performance and cycling capability. The test bed will allow for accurate heat input knowledge, temperature monitoring and cycling capability. The results will be compared to the thermal model to ensure accurate prediction capability for the next phase full-scale unit. The design description and test results would form the basis of the final report.

## Primary U.S. Work Locations and Key Partners



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## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Johnson Space Center (JSC)

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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| Organizations Performing Work         | Role                    | Type        | Location        |
|---------------------------------------|-------------------------|-------------|-----------------|
| ★ Johnson Space Center(JSC)           | Lead Organization       | NASA Center | Houston, Texas  |
| Paragon Space Development Corporation | Supporting Organization | Industry    | Tucson, Arizona |

| Primary U.S. Work Locations |       |
|-----------------------------|-------|
| Arizona                     | Texas |

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

Carlos Torrez

### Principal Investigator:

Grant Anderson

## Technology Areas

### Primary:

- TX14 Thermal Management Systems
  - └ TX14.1 Cryogenic Systems
    - └ TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors